IX. OPERATIONS & MAINTENANCE CONSIDERATIONS

Depending on the variability of the wastewater characteristics, an equalization basin may be provided ahead of the filters. The equalization basin results in less variation in influent characteristics. A steadier stream can result in higher consistency in filtration and reduced operational problems.

Commonly encountered problems in the filtration of wastewater include turbidity breakthrough, mudball formation, buildup of grease/oil and carbonates, development of cracks and contraction of filter bed, loss of filtering media, air binding, and gravel mounding. Every attempt should be made to design the filter to avoid these problems. Suggestions are incorporated in the "control measures" column. Additionally, upstream processes, such as an oil/water separator, should be considered to control potential waste constituents which may initiate operation problems.

TABLE A-11
COMMONLY ENCOUNTERED O & M PROBLEMS

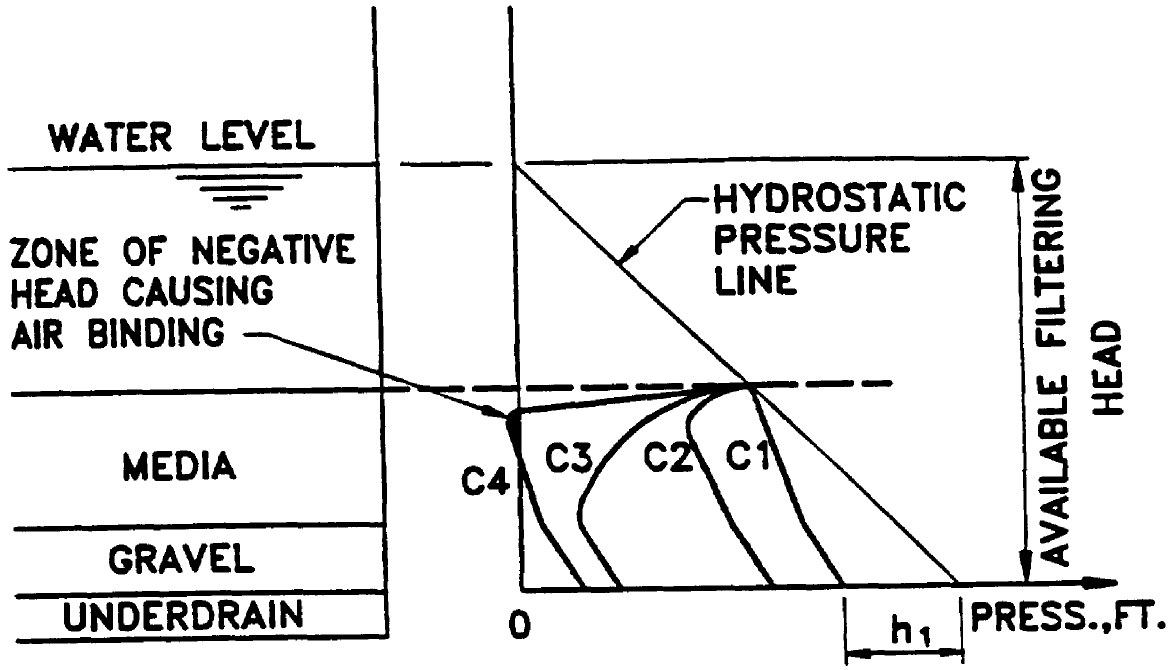
	Description	Control Measures
Turbidity Breakthrough	Unacceptable levels of turbidity in effluent before terminal head loss is reached	Pretreat with chemicals/polymers upstream of the filter bed
Mudball Formation	Masses of solids, dirt, media, etc. The mudballs sink into the filter bed, reducing the effectiveness of filtering and backwash	Auxiliary washing processes (e.g., air scour, surface wash) with, or followed by, water wash
Buildup of Grease/Oil	Oil or grease emulsifying within bed	Air and surface wash usually help. Maybe necessary to install washing system using special solutions.
Carbonate Buildup	Carbonate buildup on media after lime neutralization	Acid rinse or, for small systems, replace media.
Cracks/ Contraction	Develop when filter bed is not cleaned properly	Adequate backwash and scour.
Loss of Media	Loss during backwashing or through underdrain system.	Correct placement, sizing of washwater troughs, underdrain system.
Air Binding	Gases coming out of solution in the water due to negative heads	Backwash at terminal head loss no greater than the depth of submergence of the top of the filter media or increase submergence
Gravel Mounding	Support gravel disruption during backwash	Overlay gravel support layer with layer of high density material, such as ilmenite or garnet

Source: Metcalf & Eddy (1979), Hudson (1981)

In dual and multimedia beds, mud balls formed in the filter remain above the coal-sand interface where they are subject to auxiliary scouring, an advantage over single media beds where mudballs tend to sink to the bottom of the bed.

When the head loss at any level in the filter bed exceeds the static head to that point, a head condition below the atmospheric level (vacuum) occurs. This is commonly referred to as a negative head condition and can cause air binding of the filter. When negative head conditions occur, dissolved gases in the water are released and gas bubbles are formed within the filter bed. These trapped gas bubbles cause additional head losses and aggravate the problem even further. Air binding problems are most prevalent when there is insufficient water depth over the media and at times when the surface water is saturated with atmospheric gases because of the rising water temperatures in the spring.

If pressure taps were provided at various depths in the filter, it would be possible to establish the relative head loss at different points in the bed. Figure IX-l is a diagram of representative pressure curves through the filter bed during filtration. The hydrostatic pressure line shown in the diagram indicates the static pressure at each depth in the filter based on the water level in the filter and the available filtering head. Head loss through the filter bed can be considered as the difference between the hydrostatic pressure line and the representative pressure curves at the respective points along the pressure axis. Curve Cl represents the pressure in a clean bed at a specific filtering rate and h^{1} is the clean bed head loss. The shape of the curve shows that the clean bed head loss is proportional to the depth of the media. Curve C2 represents the pressure during clogging of the media. The upper portion of the curve shows a decrease in pressure due to the removal and storage of particles in the upper portion of the media, and correspondingly, an increase in filter bed head loss. The point where the C2 curve turns and is parallel to the Cl curve represents the depth of particle penetration into the bed; this is applicable to the other curves as well. Curve C3 shows the pressure conditions at turbidity breakthrough. At no point does the curve parallel the clean bed curve thus indicating that the particles have penetrated through the full depth of the bed. Curve C4 represents the pressure with a clogged bed condition causing air binding. There is a large pressure drop in the upper portion of the bed which is less than the static pressure to that point. This pressure is less than the atmospheric pressure and will result in dissolved gases from the water being released and forming air bubbles in the bed, even though filtering head is still available. Air



C1 - CURVE REPRESENTING PRESSURE IN CLEAN BED

C2 - CURVE REPRESENTING PRESSURE DURING CLOGGING

C3 - CURVE REPRESENTING PRESSURE AT BREAKTHROUGH

C4 - CURVE REPRESENTING PRESSURE WITH CLOGGED BED CAUSING AIR BINDING.

h_1 - CLEAN BED HEADLOSS

FIGURE A-21. DIAGRAM OF REPRESENTATIVE PRESSURE CURVES DURING FILTRATION.

binding is of particular concern at a HTRW site since hazardous volatile emissions may result from the air binding.

An additional operation issue is the time required for a filter to operate effectively immediately following backwash. After backwash, some time is needed for the filtrate turbidity to drop to an acceptable level (filter ripening). Three methods have been used to deal with this initial quality problem; filter to waste, slow initial filtration, or polymer conditioning. Filter to waste requires additional storage capacity and may present a disposal issue on HTRW sites. However, it is good practice where biological growth is a problem. The slow start alternative involves slowly opening of the filter outlet valve over a time period determined by the particular filter. Polymer conditioning uses a small amount of polymer in the backwash water in the last few seconds of the backwash cycle. A conditioning system requires polymer batching plant, pumps and an automatic control system. It may be advantageous to use slow-start in conjunction with polymer conditioning.

A significant operations issue when handling streams from HTRW sites concerns hazardous waste disposal. The attendant concerns include cost and time and care required for proper handling.

Reference. See Appendix D.